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ABSTRACT

All materials which could be acquired from the five leading computer-based guidance systems were read and evaluated for sex bias or fairness. Such analysis was done within the framework of six categories: interactive dialogue, data files, the computer program, on and off-line interest inventories, audio-visual support materials, and printed support materials. Relatively little was found which indicates serious sex bias. The descriptive content of the data files seems to have high potential for problems. The degree of sex bias or fairness which interest inventories have will have serious implications for the scope of a student's vocational exploration in systems which make use of such instruments to suggest or guide exploration. Supporting visual materials or community visitation programs can also be a source of subtle sex bias. (Author)

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SEX BIAS AND COMPUTER-BASED GUIDANCE SYSTEMS

DRAFT

Jo Ann Harris

Computer-Based Guidance Systems: A Historical Perspective

Since the 1950's the computer has revolutionized the procedures of business and industry. By 1960 it began to have an effect upon the field of education, but only on such administrative and clerical tasks as scheduling, payroll accounting, and production of report cards. The use of the computer by the student himself, for either computer-assisted instruction or guidance, was a later development, having its genesis about the mid-sixties. This paper, therefore, seeks to analyze the state of a new art, an entirely new delivery system for guidance information, in relation to issues of sex bias and fairness. Such analysis must look both at what is at this point in time and at the potential for the future of this medium as a sex-fair delivery system.

Computer-based guidance systems are defined as systems which use the computer to contribute to the making of personal, educational, vocational, and social decisions. Such systems typically include data about occuptations, colleges, technical and specialized schools, military programs, job placement, and about the user himself.

Rationale for the Use of the Computer in Guidance

The use of technology in relation to guidance services is not a new phenomenon. The profession has depended upon the results of computer-scored tests since these first became available. Further, the profession has been responsive to the availability of multi-media approaches, such as films, tape recordings, videotapes, and games, and has set professional standards for their quality.

However, in the use of technology in the past, the counselor has served as a mediator of the information which the counselee received from the technology. In the case of computer-scored tests, the computer served the counselor, who in turn interpreted the resultant test scores to the counselee. The use of audio-visual delivery systems was also supervised and mediated by the counselor. The new dimension of computer-based guidance systems has been the potential to place the inquirer or counselee directly into communication with large data files of information so that he can use them for his personal career planning without the mediation of a counselor if the user prefers to bypass it.

Given the potential of the computer to take on roles previously reserved for human attention, some rationale for doing so seems appropriate. The developers of computer-based guidance systems have recognized several inherent capabilities of computer technology which make it highly usable in the delivery of systematic career guidance:

1. The computer possesses the capability to store and instanteously retrieve masses of data. Since it is a general assumption of the profession that increased information increases the probability of good decision making, this capability is a singificant one. Further, computer technology allows the capability of instant updating of the data in the data files, thus providing current information for decision making.

2. The computer possesses the capability, by well-planned programming, to interrelate data in such a way as to make them personally relevant to the user at the time of his decision making. Thus, characteristics of students can be related to characteristics or requiremnts of occupations; student personal data can be related to the financial aids or local jobs available; student grades and test scores can be related to the entry requirements of colleges, etc.

3. The computer can sort through masses of data in order to provide a personally-tailored list of educational or vocational options for the user. With this capability, the user, for example, may acquire a list of colleges which are in the Midwest, with not more than 5,000 students, with a strong major in computer science, in urban settings, and with admission requirements which meet his qualifications. As an alternate example, the user might put together a personally-meaningful list of occupations which allow him or her a high degree of security, provide an income of over $10,000 per year, require the skills which he or she has to offer, and do not require more than two years of college training for entry.

4. The computer can, through the use of phone line connections and terminal devices (such as typewriter terminals or TV-like cathode ray tubes), be programmed to simulate a conversation. This allows the construction of structured interviews in which the computer displays a message on a

typewriter terminal or a TV-like screen and the student responds to the message by typing on a keyboard.

5. The computer can be programmed to monitor the student's use of the predesigned guidance system. This allows the capabilities of review with the student upon completion of use of the system or return to it, of pointing out inconsistencies, of reflecting patterns of consistency, or of providing feedback to counselors about the students' use of the system.
6. The computer can be programmed to allow each student a highly individualized use of the predesigned guidance system, based upon his or her own interests and degree of readiness for exploration and/or planning.
7. The computer can provide this individualized package of services to many users simultaneously, at all hours of the day, without fatigue, and in a variety of settings (schools, libraries, shopping malls, and employment agencies, for example).

In spite of the impressive list of positive reasons for the use of the computer as a delivery system for career guidance, the writer hastens to add that no developer of computer-assisted systems has proposed that computer-based systems be used to replace counselors. The question is one of determining which guidance functions can be performed as well and as cost-effectively by computers as by counselors so that these functions can be delegated to them. The

corollary is to thus provide adequate time for counselors to provide the services which only humans can provide and to do so in some meaningful interaction with the computer delivery system.

Types of Computer-Based Guidance Systems

In 1969, the United States Office of Education, Weinstein, (1969) described ten computer-based guidance systems in its volume, Computer-Based Vocational Guidance Systems. Also in 1969, Rosser (1969) listed and described fifteen commercial college locator services which use a computer to compare the desired characteristics of colleges against data stored in computer storage to produce a suggested list of colleges. In 1970, the Personnel and Guidance Journal (1970) devoted an entire issue to the topic of technology in guidance. Also in 1970, the trustees of the National Vocational Guidance Association saw the movement toward the use of computers in guidance as sufficiently significant to warrant appointing a commission to study issues and to propose guidelines for the use of computers in guidance.

The above-mentioned commission (Harris, 1971) published the final draft of its report "Toward Guidelines for Computer Involvement in Guidance" in March, 1971. The Commission looked at the approximately 25 systems existing at that time and divided them into four broad groups:

1. Indirect inquiry systems;
2. Direct inquiry systems without system monitoring;
3. Direct inquiry with system monitoring; and
4. Direct inquiry with system and personal monitoring.

Indirect Inquiry Systems

In an indirect inquiry system a counselee or client completes a questionnaire on which he may enter some data about himself and indicates the characteristics of educational institutions, financial aids or occupations which he seeks. Such systems are normally characterized by the following:

1. The counselee's request for data is held until a large group of requests can be processed through the computer program at one time, a procedure normally called "batch processing". Feedback to the inquirer involves a delay of hours, days, or sometimes weeks.

2. The counselee normally goes through this procedure only once. There is seldom opportunity for him to examine the first results of his inquiry and change specifications in order to receive a new set of suggestions. Repeated use is not possible without repeating the same initial process and, in commercial services, again paying the initial fee.

3. The data received, such as a list of suggested colleges or occupations, may fail to reflect the inquirer's most important desires and may not report all options open to him. Those who develop and distribute such systems write their computer programs in such a way that at least one alternative is suggested, but not an unwieldy number.

4. The indirect inquiry system does not provide counseling for the inquirer. In this respect it is like a dictionary or an encyclopedia. This function must be perfomed by the counselor, by another person, or by the inquirer himself.

Direct Inquiry Systems without System Monitoring

In a direct inquiry system without system monitoring, the inquirer (counselee or counselor) has direct access to the data file because he uses some type of terminal (teletype or printer) which is connected directly to a computer. The counselee or counselor, therefore, operates the terminal by use of a set of instructions

and code words to call up, using a keyboard for direct communication with the computer, data which he desires. These systems are ordinarily programmed so that a list of colleges or occupations cannot be called for until the inquirer reduces the possible number of items in the list to a reasonable number, say 25 or fewer, by specifying the characteristics which the items (colleges or occupations) must have. Such systems also ordinarily sequentially report the number of items or options still remaining in the list after the user makes each selection of an additional characteristic.

The guidance system of Interactive Learning Systems, Inc. (ILS) operates on these principles. Characteristics of direct inquiry without monitoring systems are:

1. The inquirer's request for data receives almost immediate attention.

2. The inquirer's use may be multiple or sequential, with immediate reshuffling of specified characteristics or by repeated later use of the system.

3. The computer program may allow the inquirer to receive a reasonably complete list of educational institutions or occupations which fit criteria. Whether or not a complete list can be called, the inquirer is continually aware of the filters which diminish or expand his list of alternatives, because he has applied them himself.

4. There is no counseling for the inquirer, unless by means of printed instructions. Such systems are normally designed to promote counselor participation.

Monitoring, in computer systems usage, can be defined as the overseeing capability of the computer program which keeps a record of alternatives chosen by the user, has pertinent data about the user himself, relates these data to the chosen alternative, comments on the consistency of these two in accordance with a decision table

determined by the systems designer, states the probability of success in appropriate alternatives, and reviews a path of decision-making. Such functions, programmed by the systems designer, simulate a formalized type of counseling.

Direct Inquiry with Monitoring

In a direct inquiry system with monitoring, the inquirer is also in direct communication with the computer by means of a terminal device. In this type, the terminal device is more likely to have some visual capabilities, such as a cathode ray tube or film-strip projection potential, rather than a teletype or a printer device.

Examples of this type are ECES (The Education and Career Exploration System of IBM), CVIS (Computerized Vocational Information System of Willowbrook High School), and SIGI (System for Interactive Guidance Information of Educational Testing Service). Characteristics of this third type are:

1. The inquirer's (counselee or counselor) request for data is processed immediately.
2. The counselee's use is typically multiple or sequential.
3. The counselee has at his command a variety of scripts, approaches, modes, and branching opportunities which allow him flexibility in his approach.
4. The data files generally can be accessed by various means, for example, directly (as in the second type) or by means of scripts which have monitored the user's prior response or operate from previously filed data about the user.

5. The system very often stores data about the user himself, obtained during the interactive process or previously stored, which can be meshed with data about occupations, educational opportunities, military information, and the like to generate personali.:d or new data.

6. The system provides some formalized counseling through this monitoring.

7. The system monitors the decision-making path of the inquirer and displays it for him for the sake of helping him understand his own choice-making processes, to point out inconsistencies, or to review. This system may also report the results of its monitoring to counselors so that they can participate in the counseling process.

Direct Inquiry System with System and Personal Monitoring

In a direct inquiry system with system and personal monitoring, the system is programmed to fulfill the functions outlined for the two direct inquiry systems, with and without system monitoring. This fourth type of system adds the capability for the inquirer to personalize the system monitoring procedures (the computer program). This requires that the inquirer be made aware of how the predesigned computer program functions and how to modify it "on-line" by use of one or more of the available author languages.

The ISVD (Information System for Vocational Decisions of Harvard University) is an example of this fourth type. In the ISVD, effort was made to program the system monitoring in English in order to perm{{ inquirers to modify the system programming with a lesser amount of instruction and trouble. Characteristics of the fourth type include:

1. The characteristics of the second type;
2. The characteristics of the third type: and
3. An inquirer can modify a few commands and procedures in the monitoring system (computer program) and in turn direct

the guidance system to use his own monitoring device rather than requiring him to rely fully on the system's predesigned program.

Ideally, this system would allow its inquirers to have even more flexibility in access to files so that they are not bound by inflexible, prescribed programming steps and multiple-choice responses. This concept implies extremely talented programming, highly sophisticated computer equipment, and high cost at this time. This fourth type caters to the ultimate in sense of agency for its users.

Five Existing Systems

Since the writing of the 1971 National Vocational Guidance Commission Report, computer-based guidance systems have been put to the test of operation, effectiveness, and cost-feasibility. As a result, all of the fifteen commercial indirect inquiry systems listed by Rosser (1969) have gone out of business. Two later and better models are still struggling for existence. The one outstanding example of a direct-inquiry-without-monitoring system, the Interactive Learning System, still remains strongly in the field. Four direct-inquiry-with-monitoring systems are in daily operation. The Information System for Vocational Decisions (ISVD), the one example of the fourth type of system, is now shelved due to the high cost and complexity of operation. This section of the paper will, therefore, review briefly the status of five operational systems. All five of these systems utilize time-sharing computing, that is, terminal devices are hooked via phone lines to a large central

computer. This type of system allows the use of a computer program by multiple users in various locations. The computer services these terminals in rotation, but at such a high speed that it appears that all sites are being serviced simultaneously. Typically, a student user "interacts" with the computer by pressing keys on the terminal device. The computer, in turn, "reponds" to the student by sending messages to the terminal device.

Computerized Vocational Information System (CVIS)

The Computerized Vocational Information System (CVIS) developed at Willowbrook High School (Villa Park, Illinois) and largely funded by the Illinois Division of Vocational and Technical Education, has three distinct subsystems. The first and largest provides career guidance experiences for direct student use. The guidance subsystem has ten distinct subsystems: (1) the exploration of approximately 400 occupations in an organized way and in relation to personal data about the student (for secondary level); (2) general information about four-year college planning and a search strategy for finding colleges with desired characteristics from a data file of 1510 four-year accredited institutionsl (3) detailed information about the local community college(s); (4) general information about specialized and technical schools and a search strategy for finding local ones which have training programs needed for occupations specified by the student; (5) general information about apprenticeships and specific information about entering apprenticeships locally, (6) general information about job-seeking and a search strategy for finding local job openings, (7) general information about the

military service, ROTC programs, and military academies, (8) a search strategy to find financial aids applicable to the searcher, (9) a program to assist the user to review his own school record to date and to register for the following year's courses in keeping with the school's graduation and requirements and his personal career plans; and (10) a program to assist junior high age students to explore the world of work by means of Holland's six clusters.

The second CVIS subsystem provides counselors and administrators with a host of on-line computer functions, including display of student records, updating of texts and data files, scheduling of students, schedule-changing, attendance keeping, and monitoring of student use of the system.

The third CVIS subsystem provides teachers with an easy author language for the construction of computer-assisted instruction units and a basic monitoring program for the operation of these units.

The CVIS system is programmed in basic assembly language and is therefore easily usable on IBM 360 and 370 computers. Its programs have been modified to make use of a variety of cathode ray tube and typewriter terminals. The program is in public domain and available to educational, non-profit institutions at a very nominal cost. The computer program and its supporting documentation has now been distributed to seventy school districts in the United States. These sites range from middle schools to four-year colleges, and from single-terminal installations to installations of 30 terminals. An active consortium of users has been formed for the sharing of modifications, evaluation, and cost of the updating of data files.

Occupational Information Access System (OIAS)

The Occupational Information Access System (OIAS) is the computer-based information retrieval component of the Career Information System, a statewide interagency consortium designed to provide current labor market information to individuals, schools and agencies in the state of Oregon. OIAS was developed at the University of Oregon through a grant from the United States Department of Labor. The system is made up of six components. The first is QUEST, an introductory questionnaire which helps students to assess their own interests and abilities. Students complete this questionnaire off-line and then enter their responses at the computer terminal. At this point, the computer produces a list, from a data file of 230 occupations, of those occupations which would meet the specifications set by the user. The second and third components of the system are the occupational data file and the training data file. After the computer has produced a list of feasible occupations, the student may ask for a 300-word summary of each of the occupations, including state and national labor market information, the nature of the work, and working conditions. Further, the education and training data file will be called on at this point to make a list of the educational and training opportunities in Oregon for the occupations being considered by the student. A fourth off-line component of the system is a bibliography of reference materials about occupations for the student's reading. A fifth component is a collection of taped interviews with workers in each of the occupations, and the sixth component is a computer-stored file of names of local people who are willing to discuss their occupation with students considering it. The computer provides

the user with information about the availability of the interview cassettes and the local visitations as individual occupations are considered.

OIAS is also written in basic assembly language and readily useable on IBM computer equipment; a later version of the program has been written for operation on a Hewlett-Packard 2000C configuration, making use of typewriter terminals. OIAS is fully implemented in the schools of the Eugene metropolitan area and is in operation in 40 of the 42 junior and senior high schools.

Education and Career Exploration System (ECES)

The first version of the Education and Career Exploration System (ECES) was designed and implemented by the Advanced Systems Development Division of the International Business Machine Corporation. After field trial, the system was substantially modified and implemented in the schools of Genesee County, Michigan, with substantial funding from the Mott Foundation. In late 1971, IBM discontinued development of the system and placed the program in public domain.

ECES makes use of two pieces of equipment in order to assist the user with his career planning. The first piece of equipment projects, under computer control, a film image display. These film images are contained on cassettes which the student is instructed to insert at appropriate times in the exploration process. The second piece of equipment is a typewriter terminal. The first

is used for the presentation of standard messages which all students would receive and for graphic and pictorial displays. The second piece of equipment is used to relay information which is tailor-made for the student and contains data from his own personal record.

ECES provides three on-line components and one off-line component. The first is an opportunity to explore 400 occupations. The system contains 18,000 individual color film images, including 1,000 on-the-job pictures and 1,000 simulated work problems. The second component is exploration of majors, or 400 post-secondary programs of study. This section informs the student about high school and college courses which are required to qualify for a particular occupation, including the description of 6,000 courses. The third component is charts. This section allows the personalization of the exploration by integrating information about the student's abilities and interests with information about the occupations or majors under consideration. This component of the system integrates data into useful displays which are typed by the typewriter so that these can be kept by the user. The fourth component, off-line and in batch-process mode, is the institution's finder. This component allows the user to complete a questionnaire indicating the size, geographic location, entrance requirements, and other characteristics desired of colleges, junior colleges, or technical-specialized schools. Data gathered on this questionnaire are then run against the computer-stored data file of schools, and a list of viable options is printed for the user.

ECES is currently operational only in several schools in Genesee County, Michigan. It is unlikely that this program will be used in other schools due to the cost and complexity of the terminal hardware and the cost of updating the film images.

Interactive Learning System (ILS)

The Interactive Learning System (ILS) was initially developed by a small private company in Boston, Massachusetts, which included among its staff several who had worked on the Information System for Vocational Decisions at Harvard University. The system provides an interactive search strategy for identifying a list of colleges, occupations, technical-specialized schools, or financial aids which have the characteristics desired by the user of the system. The user is provided with a booklet which lists all of the characteristics of colleges, specialized schools, occupations, or financial aids which can be used by the student in his search. The student enters his desired characteristics one at a time and is told by the system after each entry how many options still qualify. The system provides maximum flexibility for the adding or deleting of characteristics and for movement from one data file to another. In addition to the provision of a tailor-made list, the system provides descriptive information about the colleges, technical schools, occupations, or financial aids on the generated lists. Contrary to the previous three systems, no personal data about the user himself are stored.

ILS is currently a commercial operation offered by Time Share Corporation (Hanover, New Hampshire) and Houghton-Mifflin (Boston, Mass.). Computer service and data files are provided by a lease

arrangement through regional telecommunications networks attached to Hewlett-Packard 2000C processors. Individual schools who subscribe to the service install teletypewriter terminals and make use of regular voice grade phone lines.

System for Interactive Guidance and Information (SIGI)

The System for Interactive Guidance and Information (SIGI) is under development at Educational Testing Service, in Princeton, New Jersey. Financial support has been provided by the Carnegie Corporation and the National Science Foundation. The target population of the SIGI system is community college students, and the primary goal is to assist users to make better career decisions through the application of an informated decision-making process.

SIGI has four major subsystems: (1) Values, (2) Information, (3) Prediction, and (4) Planning. The Values subsystem presents the user with ten occupational values: high income, prestige, independence, altruism, security, variety, leadership, interest, leisure, and early entry. The user is asked to assign a value to each of these ten values by distributing a fixed sum in any way he chooses. Discrepancies and conflicts of values are tested by the playing of a values game which presents a series of dilemmas. Playing of the game may result in the reassessment of the priority order in which the values were first placed.

The Information component of the SIGI system provides both a search strategy and an information retrieval capability. The five

values which were rated highest by the user are used by the system to search the data file for occupations which will satisfy each of the values at the level set by the inquirer. This search strategy produces a list of occupational options. The user may then request specific information about these occupational options or compare individual elements of information about two or three occupations simultaneously for the purpose of comparison.

The Prediction subsystem allows the user to receive predictive statements about his probability of success in given courses or curricula related to his occupational choice at a given community college or colleges. These predictive statements are based on locally-built experience tables which utilize the experience of past graduates and the high school rank and selected test scores of the user himself. The Planning subsystem assists the student with specific step-by-step planning from the present point to implementation of his career choice.

SIGI is designed to operate either as a stand-alone system with a local mini-computer, or as a remote service with a larger central processor serving a number of schools via telephone lines. A PDP-11 mini-computer is currently being used with cathode ray tube terminals. The SIGI system is currently undergoing field test in one site; plans for broader field test and dissemination are in process.

Some Conclusions about the Present State of the Art

1. Of the 25-30 computer-based guidance systems which have undergone development, five remain predominantly in the field at

this time. Characteristics of those which enjoy survival are: (a) they are direct-inquiry systems; (b) they are directed to school populations at the secondary level, with the exception of SIGI; (c) they are cost feasible; (d) they make use of standard terminal equipment, with the exception of ECES; and (e) they specialize in assisting with information retrieval, sorting, and synthesis for the purpose of career decision making, although SIGI goes beyond this.

2. Computer-based systems are costing from approximately $2.00 per student hour of use (CVIS, ILS, OIAS) to $12.00 (ECES), with SIGI estimates falling somewhere in between. The inclusion of a variety of counselor-support and administrative-support functions to form an integrated educational package, as has been done in CVIS, holds high potential for minimizing the cost of student use by maximizing the cost savings and efficiency inherent in such functions as scheduling, schedule-changing, and attendance-keeping.

3. Computer-based systems have enjoyed positive evaluation even in these early prototype models. The following have been fairly universally true in the evaluation of these systems: (a) students like to use computer-based system, learn to operate them easily, and do not feel dehumanized or depersonalized by them (Harris, 1972); (b) parents accept computer-based systems with enthusiasm (Myers, et al, 1972); (c) students

who use computer-based systems show an increase in vocational maturity, as measured by instruments of vocational maturity, specifically Super's Career Development Inventory (Harris, 1972; Myers, 1972); (d) students who use computer-based systems indicate that they gain greater specificity of information about options, increase their alternatives, come to crystallization of vocational planning, and engage in a variety of exploratory behaviors to gain further information about career options (Harris, 1972); (e) some guidance-related functions (selection of high school courses and occupational exploration) can be as effectively done by a computer system as by counselors (Melhus, 1971; Price, 1971).

4. The use of computer-based systems is not currently widespread. Interest, however, is increasing as evidenced by the expanding distribution of CVIS and ILS. The distribution of the CVIS package has doubled in the past year.

Criteria and Consideration for Sex Bias in Computer-Based Guidance Systems

The problems to be addressed in this section of the paper are an analysis of the possible sources of sex bias in computer-based guidance systems and a review of existing systems for evidence of sex bias or fairness.

The National Institute of Education has proposed the following tentative definition of sex bias:

> ... Within the context of career guidance, any factor that might influence a person to limit --or might cause others to limit-- his or her consideration of a career solely on the basis of gender ...

In order to review the status of present computer-based guidance systems, it is first necessary to look at the component parts of such systems in order to fully understand the potential which such systems hold for sex bias or fairness. Sex bias or fairness may exist in any of six component parts: the interactive dialogue, the data files, the computer program, the testing instruments used on- or off-line, supporting audio-visual material, and supporting printed material. Let us analyze each of these components in some detail.

The dialogues, scripts, or text of a computer-based system are the sum total of interactive dialogue which the computer system prints or writes for a student on a terminal device in response to the student's use of the system. Such dialogue is written by the designers of a computer system and stored in computer memory or file storage. A pertinent question for testing the dialogue for sex bias would be, "Is there anything in the tone or content of the prestored computer-student dialogue which may cause the user to limit his or her consideration of a career solely on the basis of gender? A flagrant and fictitious example would be, "Boys who are interested in learning more about becoming veterinarians should read pages ___ in the Occupational Outlook Handbook." A more subtle example would be, "The following men in the community are willing to talk to students who are thinking about becoming veterinarians."

The data files of a computer-based guidance system are often quite separate entities from the computer program itself or the interactive dialogue. They are typically files of specific information about occupations, schools, and financial aids. Such data may be in free verbal form or may consist of a series of coded characteristics. CVIS provides an example of both. The occupational data file is in the form of 300-word occupational briefs which describe job duties, training requirements, working conditions, employment outlook, opportunities for promotion, and benefits/limitations for each of 377 occupations. The college data file, on the other hand, consists of a string of coded characteristics for each of 1510 colleges. The codes used indicate size range, cost range, majors offered, type of control, type of community in which the institution is located (rural, urban, suburan), degree of selectivity, etc.

Data files are a second source of bias in computer-based systems. The criterion question here is "Are there any elements in the data file or in the titles of the elements in the data file which might influence a person to limit—or might cause others to limit-his or her consideration of a career solely on the basis of gender?" The problem of non-biased occupational titles is a large one. Bias can be conveyed by the occupational title "automobile salesman"; yet finding ways to make all titles non-biased is difficult.

Beyond occupational titles, the specific content and wording of occupational descriptions pose real potential for sex bias.

A job description of beauty operator which consistently says "she cuts hair, gives permanents....; she must have good ability to meet the public..." can subtly convey to the reader that this occupation is one for women only. The reverse is true of an occupational description of engineer which begins all of its sentences with "he." Another issue in regard to content is whether or not specific figures should be reported about the percentage of women or men in a given occupation. Does the conveying of the fact that 95% of the workers in a given field are men or women bias the user of the system against that occupation, or does it simply inform him or her of the current state of affairs in the occupation so that decision can be made with maximum information? Do statements such as "Opportunities for both men and women are increasing in this field" or "Opportunities for women are increasing while opportunities for men are decreasing" help to dispel bias?

A third source for sex bias or fairness in computer-based systems is in the computer program itself. Four of the five systems described here make extensive use of a computer-stored student record which contains the user's sex. If, therefore, the computer program is written in such a way that it says, "Determine the user's sex! If the user is female, use this set of test norms and display this list of occupations, while if the user is male, use this set of criteria and display this list of occupations," this can be a significant source of potential bias or fairness. The criterion question here is, "Is there any instruction in the computer program which limits the kind or number of occupations which are presented to the user as options because of gender?"

A fourth source of sex bias or fairness in computer-based systems is the interest inventories which are used in conjunction with the user's occupational exploration. Such instruments can be home-made questionnaires or commercially published and normed instruments. They can be administered "on-line" at the terminal with immediate computer scoring, or they can be preadministered and the results entered into the student's personal record. Further, they can be used to give direction to exploration or as the search strategy for generating a list of occupational alternatives. To the extent that such instruments have sex bias in paper form, to that same extent they will have sex bias as a part of a computer-based guidance system. That sex bias may be more powerful in a computer-based system because of the kind of power the computer has as a delivery system. The criterion question is "Are sex-biased interest inventories used as a part of or in conjunction with the system?"

Accompanying visual aids are a fifth source of sex bias or fairness in computer-based guidance systems. Such visual aids may be materials which are used to orient the students to the system itself, to explain the classification system of occupations used in the system, to show "live" working conditions, or to provide simulated work problems. If all workers shown in some occupations are female, while all workers shown in other occupations are male, our present stereotypes about which occupations can be filled by which gender can be very powerfully reinforced by visual material. The criterion question is "Are visual aids used in conjunction with the system which cause persons to limit

career options on the basis of gender?"

Finally, the supporting documentation material which ordinarily accompanies a computer-based system can be the source of sex bias or fairness. Such supporting material includes counselor manuals, student manuals, and general informational pieces which are released to the public. Instructions such as "Girls may want to look especially at the occupations in the Service and General Cultural categories," or "Boys may want to pursue their vocational interests by spending a day on the job with some of our local businessmen" adequately illustrate the potential for bias in such supporting material. The criterion question is "Does any of the content of the supporting documentation cause persons to limit career options on the basis of gender?"

A Look at Five Existing Systems in Regard to Sex Bias: A Review of Materials

Preparation for writing this section of the paper was done by collecting as much information and as many samples of materials as possible from each of the five systems. Where necessary, direct contact was made with the project director and a request was made for receipt of printout of the interactive dialogue, sample data file printouts, program descriptions, and user manuals. A great deal of printed material was collected about all five systems. However, its comprehensiveness varied considerably. Due to the writer's association with CVIS, that system was available in its entirety. The ILS system was viewed in demonstration, and its student manual was studied. All ECES printouts and written descriptive material were read, but since its interactive dialogue is on

film image, this part of the system could not be scrutinized. Only descriptive material about SIGI was available without on-site visitation, but extensive conversation was held with the project director. A very good sample of all functions of OIAS was studied. The writer is indebted to Ms. Janis Brockhoff, a graduate assistant at Northern Illinois University, who read this tremendous volume of material and made extensive notes. Each of the five systems will be analyzed within the framework of the six possible sources of sex bias or fairness just presented.

Interactive Dialogue

The CVIS system has a great deal of interactive dialogue, and all of it was read. Some bias was found, as follows:

1. The CVIS military script, written in 1971, has a branch for men and a branch for women, an organizational scheme necessary at that time. With the new equality of sexes in the military, the whole military subsystem needs to be rewritten to reflect this current reality.

2. In the junior high vocational exploration subsystem, occupations are presented for exploration in the six Holland clusters. There is inconsistency in the way in which these six occupational groups are described. The characteristics of workers in some groups have been very carefully described with avoidance of the use of any personal pronoun. The word "he" seems to creep into the description of roles in the scientific and realistic groups.

3. At the end of the junior high vocational exploration subsystem, students receive assistance in thinking about course registration for high school. In describing the kinds of vocational-technical programs which are available at the high school level, auto mechanics and drafting are given as examples for boys while typing and shorthand are given as examples for girls.

4. In the high school vocational exploration subsystem, occupations are classified by Roe's eight categories. These eight categories are described to students, with sample occupations at various educational levels. A variety of job titles was used, including "typical" occupations for both men and women. However, when a job title was used which has two forms, one feminine and one masculine in gender, the masculine form was consistently chosen, ie. actor (not actress) and policeman (not policewoman).

The OIAS and ILS systems have a minimum of interactive dialogue. The purpose of this dialogue is to assist the user to identify characteristics so that these can be used in a computer search strategy. Neither of these systems have lengthy informing, clarification, or simulation material similar to that of CVIS, ECES, and SIGI. Samples of the ILS and OIAS text were read for evidence of sex bias, and none was found in either system.

The ECES system has two modes of communication with its users — a predetermined dialogue which appears on film images and charts

prepared with individualized information. It was not possible to go to Flint, Michigan to read the film images. The charts were read and no evidence of bias was found.

The SIGI system is still under development and field test in New Jersey. No samples of text could be obtained without visiting the development site. Phone conversation with Dr. Martin Katz, the project director, gave evidence that very careful attention has been paid to assure sex fairness in the writing of interactive dialogue. Sentances in the planning section have recently been revised in examples like the following: from "Ask your financial aid officer about them. He can tell you." to "Ask your financial aid officer who will tell you. . ." from "He will help you." to "Your counselor will help you."

Data Files

The list of occupations which are included in each of the five systems was read. All five systems are struggling with the same problem of inconsistency in job titles. Within the same listing, great care may be taken to separately list policeman and policewoman, waiter and waitress, busboy and busgirl, to use salesperson (house-to-house) while real estate salesman and automobile salesman are listed in masculine form only. It is evident that this is a problem to which all producers of occupational information are addressing themselves. However, some titles are very awkward to unbias, such as set-up man, draftsman, or mi. mo

Turning specifically to CVIS and its occupational data file, it became very obvious from close reading of a smaple of the 377 occupational briefs in the system that they were written by three or four writers. This data file has just been re-written and updated by the J.G. Ferguson Publishing Company, under contract to the CVIS Consortium. Some of the occupational briefs are written

very skillfully with total avoidance of the personal pronouns "he" or "she." Others, when describing job duties, consistently refer to "he" on such occupations as load dispatcher, phototypesetter, political scientist, professional athlete, university professor, ship captain, and veterinarian and to "she" on such occupations as model, receptionist, dental hygienist, dietitian, and floral designer. Inconsistency was also found in the wording of statements about employment outlook. Most occupational descriptions say "Employment outlook in this occupation is good (steady, declining, increasing)." Some say "Employment outlook for both men and women is....."

Subtle kinds of bias were also found in the wording of some CVIS occupational briefs. Examples are:

Home Economist	- ...many graduates work a short time before marrying, then leave to raise their families...
FBI Agent	- ...and wear business suits...
Boiler Operator	- ...most men in this field...
Cameraman	- ...All engraving may be done by one man...
Production manager, advertising	- ...many successful advertising men...
Pilot	- ...most men begin as co-pilots...

There was considerable consistency about the reporting of the present proportion of women in each occupation. Examples are:

Architect	- ...the percentage of women in the profession is small...
Assembler	- ...about half of all assemblers are women...

Cashier	-	...four out of five cashiers are women...
Hotel housekeeper	-	...the majority of hotel housekeepers are female...
Metallurgical engineer	-	...with opportunities for women increasing...

The OIAS system stores 230 occupational briefs, approximately 300 words in length. Seven sample briefs were obtained for reading. The problem of the use of the personal pronouns "he" and "she" has been avoided by using "they" or by using incomplete sentences without subjects. No oblique sex bias was found in the content of these job descriptions. OIAS occupational descriptions consistently report the employment outlook for women as well as men. Examples are:

Urban planners	-	Prospects are good for qualified women and minority group members...
Architect	-	Women and minority members are reportedly in demand.
Ecologist	-	Opportunities are good for qualified women and minority group members.

The "Current Local Outlook" section of the OIAS occupational briefs reports current data about the proportion of workers by sex. The description of dental assistant says that there are 170 dental assistants in the local, all females, 2/3 between the ages of 22-54, 1/3 under age 21. The description of forester says "strenuous physical requirements will preclude many women."

In a sense, the Dictionary of Occupational Titles serves as a data base to the OIAS system since students are referred there for additional information. A random sample of occupations and worker trait groups was read in the DOT. On the whole, sex bias

was not evident. Occasionally, in the Worker Trait Group description of Training and Methods of Entry, there is reference to "he." For example, the description of contract negotiating says "It is only after considerable exposure that he may be expected to function at full capacity."

The ECES occupational data file is in the form of 18,000 color film images which include on-the-job pictures showing real work situations and problem situations which people in those occupations are trying to solve. This data file could not, therefore, be read. Additional comments are included under the section on visual aids.

The ILS data file consists of the DOT characteristics and definitions of 1300 occupations. To the extent, therefore, that the DOT definitions and worker trait group characteristics have sex bias, the ILS data file has bias.

The SIGI data file consists of the responses to 27 different questions which users may ask about any single occupation or for the sake of comparison of one occupation with another. One of the 27 questions which the student may ask is "How many women are in this field?" Typical responses to this optimal question are: "35% women"; "less than 2% women"; "mostley men, number of women still growing"; or "very few women; the heavy lifting may discourage women". During the last revision of SIGI's 119 occupational descriptions, these were scrutinized for possible sex bias. Wherever sex-based reference was found, occupational descriptions

were rewritten. The following description of stewardess provides an interesting example. The title has been changed to Flight Attendant.

> Personal Characteristics:
> Should be attractive, poised, tactful, and resourceful young woman, aged 19-27, height 5'2" - 5'9", with pleasant speaking voice and good vision. Must usually be unmarried when hired, but may continue work after marriage.

The revised version of this occupation is:

> Personal Characteristics:
> Should be attractive, poised, aged 19-27, have a pleasant speaking voice, good vision, and be in excellent health. Weight and height should be in proportion: men, from 5'3" to 6' and not over 180 lb., and women, from 5'3" to 6' and not over 155 lb.

Computer Program

The computer program itself can be responsible for sex bias. CVIS provides only one example of this potentiality, although if there is bias, it lies outside the control of the system designers. In the financial aids search program, the sex of the user is determined. If the user is female, all financial aids which are available to males only are excluded from the search; if the user is male, the opposite is true.

In the OIAS system, the user takes the QUEST instrument on-line before receiving a suggested list of occupations for exploration. Item 7 asks the user if he or she prefers to work in an occupation which is filled primarily by men, by wome, or whether this is not an important consideration. The response to this item is used as one characteristic by which to sort possible occupational options. The project director has indicated that

most students say that the proportion of workers by sex is not important as a characteristic; therefore, the question will in the future be eliminated.

The SIGI system has a potential for sex bias in its Planning and Prediction section, although there is no evidence that this is in fact true. Based upon the user's rank in class and scores on the Comparative Guidance and Placement Test, predictions are made about success in given curricula based upon the experience of others with similar rank and scores. This provides a potential for comparing the scores of women users to female norm groups and the scores of men users to male norm groups. The program has, in the past, given a nursing example for females and an accounting example for males. This has been changed.

The use of interest inventories introduces another potential for sex bias. CVIS makes use of Kuder CH pre-stored data if it is in the student record in the secondary level vocational exploration subsystem. The use of the Kuder is not at all integral to the system. Roe did some research to relate the scales of the Kuder CH to the eight categories of her classification system. Since it is the custom at Willowbrook High School for sophomores to have a vocational unit in which the Kuder was given, these scores are stored as a part of the individual student record. When the student uses the vocational exploration subsystem, the eight Roe categories are explained, and the student is asked to choose one of the eight for exploration. If the one chosen is a field in which a previous Kuder score was above the 75th percentile, the

computer responds "You showed interest in this field on the last interest inventory which you took." On the other hand, if the student chooses a field on which he or she had not previously scored above the 75th percentile, he or she receives the message "This is a new area of interest for you. Go ahead and explore it. The last time you took an interest inventory you indicated interest in Science, Technology, and Outdoor." Thus, interest inventory scores are used only to point out consistency or inconsistency between past interest inventories and present exploration choices. If the student has not taken an interest inventory, the above messages are by-passed by the computer program. The Kuder CH has different norms for males and females. To the extent that this instrument has sex bias, it is reflected in a tangential way in the CVIS system.

The OIAS system uses an instrument called QUEST which was developed at the University of Oregon. It is a 25-item questionnaire which elicits preference for DOT-type characteristics so that these can be used for searching the occupational data file. Item 24 of this instrument seems to infer that "Assisting" is a female role. That item is:

Assisting — Would you like a job where you have to be pleasant to many different customers or other workers while you give or get instructions? Waitress, sales clerking, stewardess, library, and reception work are examples of assisting jobs.

Yes, I would consider jobs where this is part of the work. I do not want a job with a lot of assisting
No preference or not sure.

The ECES system makes use of the Ohio Vocational Interest Survey (OVIS) and Science Research Associates' Vocational Planning Inventory (VPI). These instruments are administered to students off-line in guidance groups. The student receives these profiles along with a search strategy which has been printed by the computer as one suggested plan in researching occupations and majors. Again, to the extent that these instruments have sex bias, that bias will be reflected in the computer's suggested plan for exploration.

The ILS system does not make use of any interest inventories. The user's search of the data bases is based entirely upon his or her choice of characteristics desired. The computer uses this combination of characteristics for its search.

The SIGI system does not make use of any interest inventories. There is a Values component in which the user assigns weights to each of ten work values and then plays a simulation game which forces him to look at value conflict and decision making in relation to values. The text of this material has been recently revised to assure that approximately half of the simulated problems involve female subjects and half involve male subjects.

Audio-
Visual Materials

The CVIS system makes use of two types of visual materials in

conjunction with the computer system. The first is a ten-minute slide-tape presentation which explains the Roe classification system used in the secondary level vocational exploration subsystem. This system divides all occupations into six levels by training and responsibility and eight field of interest (Service, Business Contact, Organization, Technology, Outdoor, Science, General Cultural, Arts and Entertainment).

Since the names of these eight fields, as well as the meaning of the six levels of training, need explanation in order to have meaning to the student, the audio-visual presentation was prepared to be shown to groups or individuals prior to use of the system. The definitions of the eight fields are illustrated by cartoons. The kinds of workers in each of the eight fields and in the six levels are illustrated by pictures of workers on the job in the local community. Care was taken to represent both men and women in the various levels of jobs in these pictures.

The CVIS junior high vocational exploration subsystem is supported by twelve audio-filmstrip cassettes, two about each of Holland's six clusters of occupations. The first set indicates the kinds of interests and abilities which young people are likely to have at the junior high level if they are to find satisfaction in the given Holland cluster of occupations. These six productions are well-balanced in terms of sex representation. The second set shows 10-15 representative occupations in each of the six clusters. These cassettes show adult workers in typical work settings and

describe their work activities. Since these productions were homemade ones and photographed in the local communities, our sex representation was largely subject to the kinds of arrangements which we could make with local employers. For this reason we have inadequately represented women in management positions in Holland's Enterprising group, in Holland's Realistic cluster in general, and in Holland's Investigative cluster in general.

OIAS does not make use of audio-visual support materials. It fills this need, however, by referring students to persons in the community who have shown willingness to talk with students who are interested in a particular occupation. The degree to which the OIAS project is able to give students a representative sample of both men and women in different occupations at different levels is contingent upon the availability of women in these positions locally and the willingness of these to volunteer for this service. Obviously, the OIAS visitation program has the same potential for sex bias or fairness that the audio-visual aid support systems do. OIAS also offers students the opportunity to listen to audio cassettes of interviews with workers. The balance represented here also provides potential for sex bias or fairness.

ECES relies very heavily upon visual aids, since its entire occupations data file is presented in this fashion. This material could not be viewed in preparation for this paper. However, the writer recalls from having seen a demonstration some years ago, that the material made heavy use of cartooning in order to minimize sex bias, racial bias, and need for constant updating due to change in styles.

The ILS and SIGI systems do not make use of any audio-visual materials.

Supporting Materials

The CVIS system provides as a part of its package a Counselor Manual, two Student Manuals (junior high and secondary level), an Operator Manual, a Technical Documentation Manual, an informational brochure, and a 16mm color film entitled "Saturday's Child." No evidence of sex bias was found in any of these materials.

The OIAS system provides a User's Handbook. The only evidence of sex bias found in this manual is in the section which describes the user's opportunity to visit local employees to talk about a given occupation. The copy says:

> You may want to visit someone and talk to him about his line of work. He may also be able to show you where he works. He is doing this because he wants to, so you do not need to be nervous about contacting him.

The continuous use of he/she and him/her gets cumbersome in writing. The constant referral to the male gender in this quotation may be generic use of the male pronoun, or alternatively, all of those who volunteered to participate in this program may be men. Either way there is potential for causing female students to limit the scope of occupations which they consider as real options.

No evidence of sex bias were found in the ILS Student Study Guide or in the ECES User's Guide. Such materials were not received from the SIGI system.

Summary

All materials which could be acquired from the five leading computer-based guidance systems were read and evaluated for sex bias or fairness. Such analysis was done within the framework of six categories: interactive dialogue, data files, the computer program, on and off-line interest inventories, audio-visual support materials, and printed support materials. Relatively little was found which indicates serious sex bias. The descriptive content of the data files seems to have high potential for problems. The degree of sex bias or fairness which interest inventories have will have serious implications for the scope of a student's vocational exploration in systems which make use of such instruments to suggest or guide exploration. Supporting visual materials or community visitation programs can also be a source of subtle sex bias.

A Look At Existing Systems in Regard to Sex Bias: Inferences from Research

The preceding lengthy section has analyzed the available content of the components of computer-based guidance systems. This section attempts to make inferences about the use and effectiveness of computer-based systems by members of both sexes, based on the available research findings. Here the reader needs to be cautioned that the amount of research which has been done on computer-based systems is relatively small; that the research studies which have been done have not had as a specific research

question the comparative effectiveness of such systems for members of both sexes; and that the inferences which can be drawn have some statistical significance but may not have practical significance. Using data from the research that has been done with CVIS and ECES, the following inferences can be drawn:

1. When allowed to use computer-based systems on a voluntary basis, male students use them slightly more than female students. Using CVIS data (Harris, 1972), 50.5% of voluntary users of the system during 1969-70 were boys, while 49.6% were girls. In 1970-71, 56.7% of voluntary users were boys, and 43.3% were girls. ECES data (Thompson, et al., 1970) indicate that the mean number of uses, on a voluntary basis, of male students was 7.2 as compared to 6.3 for female students during the field test at Montclair High School.
2. Analysis of the responses of users of computer-based systems to evaluative questions about the system suggests that females respond somewhat more favorably to such systems than males. The overriding finding is, however, that all students respond very favorably to computer-based guidance systems; prefer to use them for career information considerably more than files, references books, and other media, and often even better than counselors; and that all students learn to use computer-based systems easily, with a minimum of supervision or assistance. However, slightly higher evaluation of such systems by females is illustrated in the following

examples from the Montclair field trial of the ECES system (Thompson, et al., 1970):

How helpful to you were the instructions and information you saw today on the screen?

	M	F	
Very helpful	43	52	(number of responses)
Fairly helpful	34	19	
A little helpful	5	5	
No helpful at all	2	0	
I did not use it today.	0	2	
No response	1	0	

How helpful to you were the instructions and information you saw today on the typewriter?

Very helpful	53	57
Fairly helpful	21	13
A little helpful	7	6
Not helpful at all	1	0
I did not use it today.	1	2
No response.	2	0

How helpful to you were the instructions and information you saw today in the booklet?

Very helpful	7	22
Fairly helpful	34	17
A little helpful	18	10
Not helpful at all	9	3
I did not use it today.	15	24
No response.	2	2

3. Findings related to the relative effect of the use of computer-based systems on males and females show conflicting evidence, as illustrated here:

   a. Melhus (1971) did not find sex to be a significant variable in the measurement of change in the crystallization of vocational plans as a result of the use of CVIS. Rank in class and ability were significant main effects, however.

b. Price (1971) did not find sex to be a significant main effect in comparing the effects of counselor-registration and computer-registration using the CVIS system. By all measures used, these two forms of registration seemed equally effective for both sexes and all quartiles.

c. Harris (1972) found that CVIS does not increase the number of occupational options considered by either sex when used at the sophomore level.

d. Harris (1972) found that use of CVIS does not change the level of vocational-educational aspiration for either sex, used at sophomore level.

e. Harris (1972) found that use of CVIS causes significant increase in the range and accuracy of information possessed about specific occupations explored at the terminal, but that this increase is greater for females ($p > .01$) than for males ($p > .05$). This same inference is borne out by data from the ECES Montclair field trial (Thompson, et al., 1970).

f. When effects of the use of computer-based guidance systems are measured in terms of increase in vocational maturity, as measured by the pre- and post-administration of the Career Development Inventory (Super et al., 1971), it appears that use of computer-based systems causes gains in vocational maturity (Myers, et al., 1972; Harris, 1972) and that these gains are somewhat more significant for females than for males.

General conclusions from available research would be that computer-based systems serve both sexes equally well. Members of both sexes and their parents respond exceedingly positively to receiving guidance information through this medium and prefer it to other media, reference materials, and even counselors. Members of both sexes indicate that use of computer-based systems bring about a series of positive effects, including assistance with understanding of interests and abilities, assistance with relating interests and abilities to career choice, expansion of educational

and occupational alternatives, increase in knowledge about educational and occupational alternatives and assistance with crystallization of career plans. Further, there is evidence (Melhus, 1971; Price, 1971) to indicate that certain functions, e.g. provision of occupational information for top quartile students and registration for all students) can be as well done by computer as by counselor for both sexes. Finally, there is evidence (Harris, 1972; Myers et al., 1972) that use of computer-based systems causes increase in vocational maturity for both sexes. There is some evidence that female students will volunteer to use such systems slightly less, will evaluate them slightly higher after use, and will make slightly higher gains from their use.

Cost Considerations In Modification of Existing Systems

What would it cost to modify existing computer-based systems to free them of sex bias? The writer cannot place a dollar figure without a comprehensive knowledge of each of the existing systems from both a guidance and a technical viewpoint. However, a general statement can be made that the cost of modification of current systems to eliminate any evidence of sex bias would be quite small. This statement is based upon two premises: a) the amount of sex bias found was small, and b) the cost of update of computer-based systems is relatively small. The cost of update will also depend upon the system's capabilities and upon the parts of it which need modification. For example, the cost of update or change if the

system has on-line updating capabilities will be less than if all update must be accomplished by punched-card input. In the first case, primary cost factors would be a) the time of the guidance person in analysis of the system and decision-making about necessary changes, and b) the time of a clerical person who makes such changes by modifying text and data files at the terminal. In the second case, primary cost factors would be: a) the time of the guidance person in analysis and decision-making, b) the time of a key-punch operator, and c) the time of a programmer or systems analyst to do whatever programming may be necessary to effect the changes or to select existing programs to effect the changes.

Another highly relevant question which bears upon the cost of modification is "Where is modification necessary?" The cost of modification of text and data files (assuming that appropriate data are already existent) is relatively low. The cost of modification of printed materials and the computer program itself would be relatively higher. The cost of modification of film images, filmstrips, and videotapes would be the most expensive type of modification.

Interim Recommendations

A minimal amount of sex bias has been found in computer-based guidance systems. The author does not feel, therefore, that existing systems need to be subjected to immediate overhaul. It is suggested that the following steps be taken:

1. The general guidelines which will be proposed by this Committee should be broadly publicized to high school and community college counselors so that they can begin to be aware of potential for sex bias in general and to take appropriate measures in dealing with students.

2. Developers and implementers of the computer-based systems described in this report should be made aware of its contents. They could be asked to consider revision, wherever warranted, in the following ways and in the order indicated:

    a. Revise text.
    b. Revise any printed support material at next reprint.
    c. Revise data files at next update.
    d. Revise audio-visual materials at next update.
    e. Change interest inventories as less set-biased instruments become available.

3. Guidelines suggested in this paper should be disseminated to the developers and potential developers of new computer-based guidance systems.

Conclusions and Recommendations

This paper has summarized the current state of the art of the use of computers to assist young people with the collection and synthesis of information in preparation for career decision making. The writer proposes that the use of computers in relation to career guidance will become an increasing trend in this decade of emphasis upon accountability, construction of systematic delivery models, and career education. In the opinion of the writer, the development of computer-based systems will be characterized by the following within the next decade:

1. Computer-based systems will be used to assist with long-term career development of individuals from at least middle school through adulthood. These systems will have all of the present information-storing, retrieving, sorting and synthesizing functions characteristic of present systems; in addition, however, such systems will assist users with value clarification, learning and practice of decision-making skills, forging of individualized career patterns, and relation of occupational choice to life style.
2. Computer-based systems will be used in a greater variety of settings. Schools will continue to be the heaviest users of such systems, and ir this setting the system will be supported and enhanced by a planned program of curricular, guidance, and community activities. However, computer-based systems will also be increasingly used as stand-alone systems in such settings as libraries, shopping malls, rehabilitation centers, state employment agencies, and prisons.
3. In schools, computer-based guidance systems will be nested in more comprehensive educational data processing systems which will serve the school for computer-assisted instruction and administrative purposes as well.
4. Computer-based buidance systems will become more cost-feasible as the cost of computer equipment and phone lines continues to decline.

5. Increasing use will be made of testing instruments, both on-line and off-line, in conjunction with computer-based systems. These will include interest inventories (including the relatively new Holland Self-Directed Search andthe Harcourt Brace Ohio Vocational Interest Survey); aptitude tests which relate to occupational choice (such as American College Testing Program's Career Planning Profile, Educational Testing Service's Comparative Guidance and Placement Test, and Psychological Corporation's new interpretation of the Differential Aptitude Test); and measures of vocational maturity (such as Crites' Career Maturity Inventory, Super's Career Development Inventory, and American College Testing Program's Assessment of Career Development).
6. Computer-based systems will make increasing use of audio, visual and graphic material in conjunction with interactive dialogue and verbal data files as the technology required to control these specialized devices decreases in cost and complexity.
7. There will be an increasing attempt to use local manpower data as input to computer-based systems so that the time lag between change in manpower needs and public knowledge of these changes can be shortened. Accompanying this trend will be an increasing one to use computer-based systems to assist with the placement function.

Given the concomitant development of more sophisticated computer-based guidance systems and of equal opportunities for both sexes, action needs to be taken to insure that future computer-based guidance systems meet the needs and requirements of the new equality. Therefore, the following recommendations are made in regard to future systems:

1. Since future systems will give emphasis to career development and career patterns, such systems should give attention to information and planning which assists female users to understand alternate career patterns which they may choose. For example, attention should be given to instilling attitudes in girls at the career awareness stage about open choice of occupations, career without marriage as an acceptable option, or career with marriage as an acceptable option; to planning for reentry into the job market after childbearing or raising; to attainment of skills for initial entry into the job market in the period of life which would for others be a period of maintenance of career; to adjustment to varying life roles at various stages in life; and to value clarification and decision making in relation to career, marriage, and childbearing.
2. Since computer-based systems will be used in a greater variety of settings with users of a much wider age span, attention should be given to making such systems maximally available. In addition to schools, computer-based systems should be available in libraries, shopping malls, or via the home phone and television set.

3. Since computer-based systems will make greater use of testing instruments, continuing exerted attention should be given to the development of sex-fair measures of vocational interest, aptitude, and maturity.

4. Since visual materials will become a cost-feasible component of computer-based systems, attention should be given to the development of guidelines for the presentation of occupational information through films, filmstrips, video cassettes, and tape recordings in such a way that present stereotypes about latitude or level of vocational choice for women can be dissolved. Such guidelines would suggest that equal numbers of men and women be represented with an even spread of each over the varying fields and levels of occupational endeavor.

5. Since computer-based systems will make increasing use of manpower data both for informational purposes and for job placement, continuing attention should be given to the collection and synthesis of data about the number and position of women in the work force.

6. Future systems should be developed in keeping with guidelines implied in this paper. These guidelines include:

   a. In regard to interactive dialogue

      In the writing of the interactive dialogue, great care should be taken to make the text as sexless as possible. This can be accomplished by:

      1) using both pronouns "he" and "she", using the plural "they", or using generic terms such as "individuals" or "persons".

2) giving examples which represent an equal number of men and women in occupations in different fields and at different levels and which do not reinforce the typical stereotypes.

3) writing simulation problems which pose decision-making situations for both sexes in equal number, scope, and complexity.

b. In regard to data files

In the construction of data files about occupations, great care should be taken to present all occupations as equal options to members of both sexes. This can be accomplished by:

1) making all occupational titles in the file as sexless as possible, or where necessary, using double titles.

2) presenting factual information about job duties, skill and training requirements, working conditions, benefits and limitations, and psychosocial factors of occupations without reference to the appropriateness of the occupation for men or women.

3) providing accurate, updated data about the proportion of the sexes in individual occupations. Such data gives the user accurate information about the present status of men and women in a given occupation so that he or she can fix probabilities and make personal decisions.

c. In regard to computer program

Computer programs should be written in such a way that no occupations are eliminated from the user's exploration on the basis of the user's sex.

d. In regard to use of testing instruments

If measures of vocational interest, vocational aptitude, or vocational maturity are used in conjunction with a computer-based system, either off-line or on-line, a careful check should be made on these instruments to determine whether or not the test items or the method of norming constitutes sex bias.

e. In regard to use of audio-visual support materials

Audio-visual materials used in conjunction with computer-based guidance systems should reflect sex fairness by representing an equal number of men and women. This representation should be spread proportionately over the fields of occupational endeavor and the levels of occupational endeavor.

f. In regard to written support materials

The supporting materials which are used in conjunction with computer-based guidance systems should reflect sex fairness by representing equality of occupational choice in the content of the verbal material, the pictures shown, and the instructions given for use of the system components.

It is recommended that these guidelines be presented to the Publication Committee of the National Vocational Guidance Committee for inclusion in the next printing of Tested Practices: Computer-Assisted Guidance Systems (Harris, 1972).

In conclusion, the author proposes that the computer is potentially a very powerful delivery system for non-sex-biased career information and guidance. Given the application of the guidelines proposed, the computer system will deliver equal information and treatment to all students who sit at its terminals regardless of sex, race, color, or disadvantage. The computer is a totally impartial and objective tool. It is devoid of all of the non-verbal cues which characterize human communication. Yet, in spite of this objectivity, it is viewed by students as personal if it stores and uses personal data about the user. Some of the less formal evaluation of the CVIS system indicates that students feel that counselors have preconceived notions about which occupations are appropriate for them to enter. Therefore, students will not discuss occupations with their counselors that they perceive to be unacceptable to their counselors. On the other hand, students feel that the computer is completely objective, producing the same list of occupations for all students who enter the same characteristics and producing, without comment, occupational information about any occupation requested. In addition, it allows a student to explore as many different occupations as he wishes, some of very little or marginal interest to the student, with a "What if?" kind of

attitude and a minimum of commitment. Although printed resource material can provide the same advantages, the computer system both allows the interrelationship of personal data to the exploration and has a much higher interest and motivation factor for the student.

These capabilities allow users of computer-based systems to receive a vast quantity of non-biased information with which to exercise personal choice, freedom, and decision. Computer-based systems can provide great assistance with the non-biased delivery of information about occupational choice to individuals of all ages. Other forces will have to make impact upon the early conditioning of girls about their role in society and upon the willingness of society in general to accept women in new roles.

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"Technology in Guidance," special issue of Personnel and Guidance. Journal, November, 1970.

MATERIAL READ ABOUT THE PROJECTS

Computerized Vocational Information System:

CVIS: A Futuristic Concept of Educational and Vocational Decision Making
CVIS: Counselor Manual
CVIS: Student Manuals
All interactive dialogues
All occupational briefs

Super, D.E. et al. Career Development Inventory, Form I. New York: Teachers' College Columbia, 1971.

Thompson, et al. The Educational and Career Exploration System: Field Trial and Evaluation in Montclair High School. New York: Teachers' College, Columbia, 1970.

Education and Career Exploration System:

ECES: User's Guide
ECES: Career Decision-Making Program
ECES: Examples of Charts

Samples of dialogue

Interactive Learning System:

Guidance Information System: Student Study Guide

Occupational Information Access System

Career Information System: Computerized Occupational Information System
Career Information System: User's Handbook
Sample occupational briefs and interactive dialogue

System for Interactive Guidance Information:

Katz, M., Chapman, W., and Godwin, W. "SIGI - A Computer-Based Aid to Career Decision-Making", EDUCOM Bulletin, Summer, 1972.

Katz, M., Norris, L., and Chapman, W. SIGI: Report of a Pilot Study under Field Conditions. Princeton: Educational Testing Service, 1973.